139-4 Restoration of SOC Pools Under No-till Systems in Subtropical and Tropical Regions of Brazil.

Florent e. Tivet[1], João Carlos M. Sá[2], Rattan Lal[3], Clever Briedis[4], Serge Bouzinac[1] and Lucien Séguy[5], (1)PERSYST, UR SIA, CIRAD, Montpellier, France
(2)Departamento de Ciencia do Solo e Engenharia Agricola, Universidade Estadual de Ponta Grossa, Ponta Grossa, Brazil
(3)School of Environment and Natural Resources - The Ohio State University, Carbon Management and Sequestration Center, Columbus, OH
(4)Av. Carlos Cavalcanti, 4748, Universidade Estadual de Ponta Grossa, Ponta Grossa, PR, BRAZIL
(5)Agroecoriz, Montpellier, France

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Abstract
The conversion of native vegetation (NV) into agricultural land by clearing and tillage disrupts structure, and depletes soil organic carbon (SOC) pool. The data on changes in SOC pools are needed to enhance scientific knowledge regarding the effects of land use and no-till (NT) systems on soil fertility, agronomic productivity, and soil C sink capacity. Thus, the objective of this study was to quantify changes in SOC fractions due to conversion of NV to agricultural land, and to assess the rate of recovery of SOC fractions and the resilience index of NT systems under sub-tropical (Ponta Grossa, PR) and tropical (Lucas do Rio Verde, MT) regions of Brazil. Five different fractions of SOC pools were extracted by chemical methods (i.e., C in the polysaccharides – CTPS, hot-water extractable C – HWEOC, chemically-stabilized organic C – CSOC), and physical fractionation (i.e., particulate organic C – POC, and mineral associated organic C – MAOC). Land use change primarily altered the labile (HWEOC, TPS, POC) and also some of the stable (MAOC) pools at both sites. The CSOC pool was almost constant throughout the soil profile and represented, accross land uses, 7.2 g C kg-1 at the PG and 3.1 g C kg-1 at the LRV site. At the PG site, the HWEOC and CTPS concentrations in 0-5 cm depth decreased by 56% (1.21 g kg-1) and 45% (7.21 g kg-1) in CT soil, respectively. At the LRV site, concentrations of HWEOC and CTPS in 0-5 cm depth decreased by 50% (0.4 g kg-1) and 42% (4.8 g kg-1), respectively. In contrast, concentrations of HWEOC and CTPS fractions in soil under NT in 0-20 cm depth were equal to or even higher than those under NV, and exhibited a distinct gradient from surface to sub-soil layers. The adoption of CT reduced POC by 46% (4.7 Mg ha-1), and MAOC by 21% (15.1 Mg C ha-1) in 0-20 cm depth at the PG site. Using CT for 23 years at the LRV site, decreased SOC fractions in 0-20 cm depth at the rate of 0.25 and 0.34 Mg C ha-1 yr-1 for POC and MAOC, respectively. In contrast, adoption of intensive NT systems in tropical agro-ecoregions increased POC at the rate of 0.23 to 0.36 Mg C ha-1 yr-1, and MAOC by 0.52 and 0.70 Mg C ha-1 yr-1. With a high and diversified input of biomass in intensive NT systems higher resilience index was observed for CTPS, HWEOC, and MAOC. The variation in SOC among CT and NT systems was attributed to the silt + clay associated-C, indicating that a significant proportion of the SOC associated with minerals is relatively labile, and that physical stabilization of SOC plays a significant role in the restoration of SOC.

Keywords: Cerrado, tropics, soil carbon sequestration, soil C fractionation, land use change, soil resilience

Abbreviations: CA, conservation agriculture; CEC, cation exchange capacity; CN, carbon nitrogen; CSOC, chemically stabilized organic carbon; CTPS, carbon in total polysaccharides; CT, plow-based conventional tillage; Febrapdp, Brazilian federation of no-till; HWEOC, hot-water extractable organic carbon; LRV, Lucas do Rio Verde; MAOC, mineral-associated organic carbon; MT, Minimum Tillage; NT, no-till; NV, native vegetation; OM, organic matter; PG, Ponta Grossa; POC, particulate organic carbon; SOC, soil organic carbon; SOM, soil organic matter; TOC, total organic carbon; TPS, total polysaccharides.